Arboviral Encephalitides

Report Immediately

March 2004 High Point

Note: For information about West Nile virus encephalitis, refer to the chapter entitled West Nile virus encephalitis. This chapter focuses on the arboviral encephalitides others than caused by West Nile virus.

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

There are about 570 viruses worldwide that are spread through arthropods (insects). More than 30 of these arboviruses have been identified as human pathogens in the western hemisphere. In New Jersey, three mosquito-borne arboviruses that cause encephalitis in humans have been identified: Eastern equine encephalitis (EEE), Saint Louis encephalitis (SLE) and West Nile virus (WNV). EEE is a member of the family *Togaviridae*, genus *Alphavirus*. SLE is a member of the family *Flaviviridae*. WNV, also a member of the *Flaviviridae* family and *Flavivirus* genus, has recently appeared in the Northeast. California encephalitis has been reported in New York and Connecticut, and Jamestown Canyon virus has been isolated from mosquitoes in New England. Other important arboviral encephalitides in the Americas include Powassan encephalitis, Venezuelan equine encephalitis (VEE), Western equine encephalitis (WEE), LaCrosse encephalitis, Tensaw encephalitis, Everglades encephalitis, Ilheus encephalitis, and snowshoe hare encephalitis.

B. Clinical Description and Laboratory Diagnosis

Encephalitis is an inflammation of the brain. Arboviral infection may result in an acute febrile illness of variable severity and rate of progression including aseptic meningitis (inflammation of the linings of the brain and spinal cord) to encephalitis (inflammation of brain tissue). Many arboviral infections are asymptomatic. Arboviral encephalitis cannot be distinguished clinically from many other causes of encephalitis. Manifestations can include headache, confusion, lethargy, nausea, altered consciousness, vomiting, fever, cranial nerve palsies, paresis (muscular weakness) or paralysis, sensory deficits, altered reflexes, tremors, convulsions, abnormal movements, coma of varying degree, and, in some cases, death. The case-fatality ratios ranges from less than 1% to 60%. For example, the first symptoms of EEE generally include a sudden onset of high fever, stiff neck, headache of increasing severity, lack of energy and general muscle pain. EEE is a serious neurologic infection and can lead rapidly to seizures, coma and death. As many as one-third of EEE cases are fatal. In contrast, mild infection with SLE occurs without apparent symptoms other than fever with headache. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (especially in infants) and spastic (but rarely flaccid) paralysis. The case-fatality ratio ranges from 3% to 30%, especially in the elderly. The other arboviral encephalitides produce similar clinical pictures varying in severity.

Laboratory diagnosis is based upon demonstration of specific IgM in serum or CSF, or antibody rises between early and late specimens of serum by neutralization, complement fixation (CF), hemagglutination (HA), direct fluorescence (IF), enzyme linked immunoassay (ELISA) or other serologic tests. Cross-reactions may occur within related virus groups also, the virus occasionally can be isolated from blood or CSF.

C. Reservoirs

Reservoirs for many of the arboviral encephalitides are not known. Birds carry both EEE and WNV. The virus usually resides in birds and the mosquitoes that feed on them. Rarely, other kinds of mosquitoes that also bite people and horses pick up the viruses. In New Jersey, the primary bird vector of EEE is a freshwater swamp

mosquito, *Culiseta melanura*, while the human vector is the salt marsh mosquito, *Ochlerotatus sollicitans*. Humans and horses are generally considered dead-end hosts. The vectors for California encephalitis, LaCrosse encephalitis, snowshoe hare encephalitis, and Jamestown Canyon virus are *Aedes* mosquitoes. The vector for Powassan encephalitis virus is the *Ixodes cookei* tick, and the reservoir includes rodents, other small mammals and birds. VEE is maintained in a rodent-mosquito cycle; horses are also an important reservoir during outbreaks of VEE.

D. Modes of Transmission

EEE, Ilheus encephalitis, snowshoe hare encephalitis, SLE, California encephalitis, Jamestown Canyon virus, WEE, LaCrosse encephalitis, VEE, Tensaw encephalitis, and Everglades encephalitis, are spread to humans by the bite of an infected mosquito. Powassan encephalitis is spread to humans by the bite of an infected tick (*Ixodes cookei*). Direct person-to-person spread of arboviral infections does not occur.

There is no evidence that a person can get EEE from handling most live or dead infected birds or horses. However, EEE is known to be spread from bird-to-bird in flocks of rattites (emus, ostriches, and rheas). Rattites are large, flightless birds from Australia, Africa, and South America that are sometimes raised in the Northeast as livestock or zoo animals. In these birds, EEE causes a syndrome characterized by gastroenteritis and hemorrhage, and blood excreted in feces or secreted from other orifices is considered to contain large quantities of virus. Therefore, strict precautions should be taken when handling sick or dying rattites infected with EEE and their secretions or excretions. With animals other than rattites infected with EEE, gloves or double plastic bags should be used when handling dead animals.

E. Incubation Period

The incubation periods for some of the arboviral encephalitides are as follows: EEE, 3–10 days; California encephalitis, 5–15 days; Powassan encephalitis, 4–18 days; SLE, 4–21 days; VEE, 2–6 days; WEE, 5–10 days; and LaCrosse encephalitis and Jamestown Canyon virus, 5–15 days.

F. Period of Communicability or Infectious Period

Arboviral infections or agents are not communicable from person-to-person.

G. Epidemiology

Signs of equine (horse) encephalitis were first noted in the eastern U.S. as early as 1831. Over one hundred years later, the EEE virus was recovered from a horse brain in New Jersey in 1933. The virus was first isolated from a human case in 1938 during an outbreak in southeastern Massachusetts. EEE is found in the eastern and north central regions of the U.S. and adjacent regions of Canada, as well as in portions of Central and South America. The greatest risk of acquiring EEE is from late July through October (until the first sustained frost). The risk is highest from southeastern New England to Florida and the Gulf states, especially along the coastal regions. Since 1964, there have been 153 confirmed human cases of EEE nationwide. The outbreak of EEE in coastal areas of New Jersey in 1959 resulted in 32 human cases (including 22 fatalities). Subsequent serologic surveys in the affected communities showed that approximately 2% residents had evidence of recent EEE infection. Another outbreak in 1968 resulted in 12 human cases. A total of 54 human cases of EEE had been confirmed between 1959 and 2003 in New Jersey.

New Jersey had significant outbreaks of SLE in 1964 and 1975. Most cases of arboviral encephalitis in North America occur in the late summer and early to mid-fall. The elderly are at greatest risk of encephalitis with SLE, while children under 15 years old are at greatest risk from LaCrosse virus infection, and both children and elderly are at greatest risk for EEE. WEE is found in the western and central portions of the U.S., in Canada, and in parts of South America. SLE is found in most of the U.S., as well as in parts of Canada, the Caribbean Islands, and Central and South America. LaCrosse encephalitis is found in the eastern half of the U.S. Snowshoe hare encephalitis occurs in Canada, China and Russia. Powassan encephalitis occurs in Canada, the U.S. and Russia. VEE is endemic in parts of South and Central America and the Caribbean.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. The New Jersey Department of Health and Senior Services Case Definition

A. CONFIRMED

A febrile illness associated with neurologic manifestations ranging from headache to aseptic meningitis or encephalitis, **AND**

- Fourfold or greater change in serum antibody titer; **OR**
- Isolation of virus from or demonstration of viral antigen or genomic sequences in tissue, blood, cerebrospinal fluid (CSF), or other body fluid; **OR**
- Specific immunoglobulin M (IgM) antibody by enzyme immunoassay (EIA) antibody captured in CSF or serum. Serum IgM antibodies alone should be confirmed by demonstration of immunoglobulin G antibodies by another serologic assay (*e.g.*, neutralization or hemagglutination inhibition).

B. PROBABLE:

Clinically compatible case occurring during a period when arbovirus transmission is likely, and with the following supportive serology:

- An elevated (≤ twofold change) antibody titer to an arbovirus (*e.g.*, ≥1:320 by hemagglutination inhibition, ≥1:128 by complement fixation, ≥1:256 by immunofluorescence, and ≥1:160 by neutralization, or ≥1:400 by enzyme immunoassay IgM).

C. POSSIBLE:

Not used.

B. Laboratory Testing Services Available

The NJDHSS Public Health and Environmental Laboratories (PHEL) are performing IgG and IgM EIA tests for WNV on human serum and CSF specimens, IgM test for EEE on serum, and SLE antibodies tests on human serum and CSF specimens. Accurate information about date of collection, date of onset of symptoms, travel history, flavivirus vaccination and disease history are essential for test interpretation. For additional information on submitting samples or testing for other types of arboviral infection, contact the NJDHSS Infectious and Zoonotic Diseases Program (IZDP) at 609.588.7500**.**

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify locally acquired cases of EEE infection in humans to better understand the local epidemiology of EEE virus.
- To identify locally acquired cases of EEE infection in humans to help target mosquito control measures.
- To identify cases of other arboviral infections (*e.g.*, California encephalitis, St. Louis encephalitis) in New Jersey residents or visitors to determine whether they are imported or locally acquired.

- To provide residents of New Jersey and travelers to the state with appropriate preventive health information.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that laboratories and health care providers report (by telephone, confidential fax, over the Internet using the Communicable Disease Reporting System [CDRS] or in writing) all cases of arboviral encephalitis defined by the reporting criteria in section 2A above to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located.

Note: Due to the rarity and potential severity of arboviral encephalitis, NJDHSS requests that information about any suspect or known case of arboviral encephalitis be **immediately reported** to the local department of health where the illness was diagnosed. If this is not possible, call the IZDP at 609.588.7500 (weekdays), or 609.392.2020 (emergency number for nights/weekends). A case is defined by the reporting criteria in Section 2 A above.

C. Local Department of Health Responsibilities

1. **Reporting Requirements**

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of arboviral encephalitis as defined by the reporting criteria in Section 2A above. Current requirements are that cases be reported to the NJDHSS IZDP using the CDS-1 Reporting FormA report can also be filed electronically over the Internet using CDRS.

2. **Case Investigation**

a. **The most important step a local health officer can take if he/she learns of a suspected or confirmed case of arboviral encephalitis is to call the NJDHSS IZDP immediately.** The daytime phone of the IZDP is 609.588.7500. The phone number for nights, weekends, and holidays is 609.393.2020.

b. Case investigation of arboviral encephalitis in New Jersey residents will be directed by NJDHSS.

c. Health officers may be asked to assist in completing a CDS-1 Reporting Form by interviewing the case and others who may be able to provide pertinent information or the case can be reported electronically using CDRS. Most of the information required on the form can be obtained from the healthcare provider or the medical record.

d. Use the following guidelines in completing the form:
   1) Record encephalitis as the disease being reported.
   2) Indicate the organism isolated/identified, if known.
   3) Indicate the type of specimen from which the virus was isolated/identified, if known.
   4) Accurately record the case-patient's demographic information.
   5) Record the date of symptom onset, date of hospitalization and other relevant dates. Other medical information can be recorded in the "Comments" section at the bottom of the page.
   6) Record the case's travel history: determine the date(s) and geographic area(s) traveled to by the case-patient up to 30 days before onset. Questions about travel history are asked to identify where the patient may have become infected. This information can be recorded in the "Comments" section at the bottom of the form.
   7) Include any additional comments regarding the case.
   8) If there have been several attempts to obtain patient information (*e.g.*, the patient or healthcare provider does not return calls or respond to a letter, or the patient refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as possible. Please note on the form the reason why it could not be filled out completely. **If CDRS is used to report, enter the collected information into the "Comments" section.**

e. Completed forms should be FAXED to the NJDHSS IZDP (fax 609.588.3894 or 609.631.4863), or the report can be filed electronically over the CDRS. The mailing address is:

NJDHSS
Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
P.O. Box 369
Trenton, NJ 08625-0369

f. Institution of disease control measures is an integral part of case investigation. It is the local health officer responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements

For most cases of arboviral encephalitis, there are no isolation and quarantine requirements. However, for encephalitis caused by an organism that is otherwise reportable, please refer to the chapter of that specific organism or disease for the appropriate isolation and quarantine requirements.

B. Protection of Contacts of a Case

In most cases of arboviral encephalitis likely to occur in New Jersey, there are no recommendations for protection of contacts of a case. There is no approved vaccine available, and transmission from person-to-person and animal-to-person (except from rattites) does not occur. Since humans are considered to be dead end hosts for WNV, EEE, and SLE, special mosquito control protections for contacts of a case are not necessary.

C. Managing Special Situations

Locally Acquired Case

If you determine during the course of the investigation that a case-patient does not have recent travel history to an endemic area or county, environmental measures such as investigating local areas visited by the case (including their residence) to locate the focus of infection and surveillance of other people for illness may be necessary. The NJDHSS IZDP should be notified for consultation in these cases, as well as the State and county mosquito control agencies responsible for conducting surveillance and control activities. Mosquito surveillance in areas visited by the case-patient will help to identify the presence and populations of vector mosquitoes and determine the appropriate control measures. See next section below.

Reported Incidence Is Higher than Usual/Outbreak Suspected

If an outbreak is suspected, contact the NJDHSS IZDP at 609.588.7500. The situation may warrant an investigation of clustered cases and implementation of additional mosquito surveillance in a particular area by State and county mosquito control programs. The Program staff can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several jurisdictions and therefore be difficult to identify at a local level.

D. Preventive Measures

Environmental Measures

The New Jersey Department of Environmental Protection's Office of Mosquito Control, Rutgers University and the county mosquito control agencies conduct environmental surveillance of mosquitoes in numerous sites throughout the state for WNV, EEE, and other vector-borne diseases. Results of mosquito surveillance can be accessed on NJDHSS website at <http://www.state.nj.us/health>.

Mosquito control agencies in all counties of New Jersey follow integrated mosquito management practices, such as water management, for mosquito control. Decisions about the need for special mosquito adulticide spraying are normally made by the county mosquito control agencies (based on mosquito habitat and density, surveillance for EEE or WNV virus in mosquitoes, numbers of cases in birds and other animals, and numbers of cases in humans). The State Mosquito Control Commission supports a State Airspray Program, which can also apply mosquito larvicides and adulticides, as required, in participating counties.

Personal Preventive Measures/Education
People, particularly those living in or visiting high-risk areas, are encouraged to protect themselves from mosquito bites by the use of repellents and protective clothing. They should also stay indoors at dawn and dusk when mosquitoes are most active and use gloves when handling horses and birds that are sick with or have died from arboviral infection. Persons in the environment of rattites (emus, ostriches, rheas) infected with EEE should take strict precautions when handling sick or dead animals or their secretions/excretions.

The homeowner should be advised to practice good sanitation to reduce mosquito populations and prevent mosquitoes from entering the home. Window and door screening should be in good repair. Standing water on residential properties should be eliminated to prevent the development of container breeding mosquitoes. Some examples include clearing debris from gutters, removing old tires and useless containers, changing water in birdbaths every week, and maintaining properly pools.

ADDITIONAL INFORMATION

A *West Nile Virus and Eastern Equine Encephalitis Fact Sheets* can be obtained at the NJDHSS website at http://www.state.nj.us/health. Click on the "Topics A to Z" link and scroll down to the subjects *WNV and EEE*.

The following is the formal CDC surveillance case definition for arboviral encephalitis. It is provided for your information only and should not affect the investigation or reporting of a case that fulfills the criteria in Section 2 A of this chapter. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. When reporting a case to the NJDHSS always use the criteria outlined in Section 2 A.

Laboratory criteria for diagnosis
- Fourfold or greater change in serum antibody titer; or
- Isolation of virus from or demonstration of viral antigen or genomic sequences in tissue, blood, cerebrospinal fluid (CSF), or other body fluid; or
- Specific immunoglobulin M (IgM) antibody by enzyme immunoassay (EIA) antibody captured in CSF or serum. Serum IgM antibodies alone should be confirmed by demonstration of immunoglobulin G antibodies by another serologic assay (*e.g.*, neutralization or hemagglutination inhibition).

Case classification
Probable: a clinically compatible case occurring during a period when arbovirus transmission is likely, and with the following supportive serology: a stable (≤ twofold change) elevated antibody titer to an arbovirus (*e.g.*, ≥1:320 by hemagglutination inhibition, ≥1:128 by complement fixation, ≥1:256 by immunofluorescence, and ≥1:160 by neutralization, or ≥1:400 by enzyme immunoassay IgM).
Confirmed: a clinically compatible case that is laboratory confirmed.

Comment
Arboviral transmission varies according to season and depends on the geographic location of exposure, the specific cycles of viral transmission, and local climatic conditions. Reporting should be etiology-specific (see below; the four encephalitides printed below in bold are nationally reportable to CDC):
- **St. Louis encephalitis**
- **Western equine encephalitis**
- **Eastern equine encephalitis**

- **California encephalitis serogroup** (includes infections from the following viruses: LaCrosse, Jamestown Canyon, Snowshoe Hare, Trivittatus, Keystone, and California encephalitis viruses)
- Powassan encephalitis
- Other CNS infections transmitted by mosquitoes, ticks, or midges (*e.g.*, Venezuelan equine encephalitis and Cache Valley encephalitis)

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